The Design of Valve Cone Grinder Automatic Pneumatic Feeding System

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Abstract. In the paper, a kind of valve cone grinder feeding system was designed. It improved the processing quality because a mechanical hand, which can conduct accurate location in the valve cone grinding process, was used to feed automatically. At the same time, it reduced the labor intensity of workers that greatly improved the production efficiency, solved the problem, that the workers was easy to get hurt in the process of carrying out the valve, enhanced the safety of the production process.

Introduction

The valve is in the process of the engine working seal and control the engine combustion chamber gas exchange of seal, is the guarantee an important part of a engine performance, fuel economy and reliability. Of the valve and valve seat ring is the cone on the fitting surface, is one of the main valve fitting surface, its working status directly affect the output power of engine. And processing quality is the guarantee of the valve cone valve working in good condition of the most fundamental factors.

Valve processing belong to mass production, the processing quality depends largely on the accuracy of machine tool and rigid, and higher efficiency of production machine tool is to satisfy the premise of mass production, the valve cone grinding process, positioning and clamping usually adopt installed on the spindle three-point support or double cone top clamp tooling, or use manual clamping collet chuck, manual operation, the clamping process automation degree is low, lead to valve centering are not allowed to be in the processing, the quality is not stable; And normally valve loading are mostly done by manual operation, operators operating frequency is high, the labor intensity is big, because the valve of the scale of production to mass production, relatively high degree of automation, machine tool production takt time is short, loading operation more frequently, and with the development of economy, human resources cost is higher and higher, people demand for automated production will gradually increase, loading and unloading material by artificial condition have been unable to adapt to the requirements of production.

In this paper, design of the valve cone grinding machine automatic pneumatic conveying system is with the chongqing sinopac elite valve co., LTD., university-enterprise cooperation project, which can realize automatic feeding manipulator, blanking, stable running, high efficiency.

The Structure of the Pneumatic Conveying System

Figure 1 for automatic pneumatic feeding system of the three-dimensional entity model figure, mechanical structure mainly has the fuselage, bunker, manipulator forearm, manipulator arm, pushing device of five parts, such as [1-2], five were using pneumatic actuators, picking 2 telescopic cylinder to control the manipulator forearm rotation, the material cylinder 1 from bin isolated single valve gets stuck, turning 60 degrees, down 11 telescopic cylinder can control the manipulator arm can swing arm rotation, manipulator arm driven in telescopic cylinder 9 into the upper valve and telescopic cylinder 9 retract, 8 telescopic arm, telescopic arm at the bottom of the collet chuck clamp valve, valve grinding machine processing to the mouth, pushing 6 pushes it into the cylinder, the cone grinding processing.
1 - material cylinder; 2 - material cylinder; 3 - manipulator forearm; 4 - the base; 5 - valve; 6 - pushing cylinder; 7 - grinding wheel; 8 - telescopic boom; 9 - telescopic cylinder; 10 - manipulator arm; 11 - swing arm cylinder; 12 – bin

Figure 1. Pneumatic conveying system of three-dimensional entity model figure.

**The Working Process of the Pneumatic Conveying System**

The initial status of the five cylinder as shown in figure 1, respectively is: material cylinder retracted, picking back, back swing arm cylinder, telescopic cylinder reach out back, pushing cylinder cylinder. To complete a cycle of the working process of the valve cone grinding automatic feed as shown in figure 2. In order to make the whole process with rhythmic movements, cohesion is fluent, while points out material cylinder start 5 seconds delay relay [3], back at the same time also start 5 seconds delay relay, retract, for the second time in telescopic cylinder that is ready to the valve to the grinding machine processing, material cylinder back to the initial state (4-6).

Figure 2. Valve cone grinding machine automatic feeding work cycle diagram.
The Pneumatic Circuits of the Feeding System Design

![Figure 3. Valve cone grinding machine automatic feeding system pneumatic circuit diagram.](image)


The valve cone grinding machine automatic feeding system pneumatic circuit diagram as shown in figure 4 [7]. With five cylinder, four two five-way single electric solenoid valve. Telescopic cylinder vertically, suddenly loses power or emergency braking, cylinder piston to fall by gravity, so chose three five double electric control reversing valve, the median function for the "O" type, the oil mouth closed, cylinder lock.

<table>
<thead>
<tr>
<th>Serial number</th>
<th>Work cycle</th>
<th>Signal source</th>
<th>1YA</th>
<th>2YA</th>
<th>3YA</th>
<th>4YA</th>
<th>5YA</th>
<th>6YA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dividing cylinder</td>
<td>Start button, 2B1</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>delayed 0.5S</td>
<td>Start button, 2B1</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>retraction</td>
<td>Delay relay 1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>delayed 0.5S</td>
<td>Delay relay 1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Receiving cylinder extension</td>
<td>Delay relay 2</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Swing arm cylinder</td>
<td>2B2</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Telescopic cylinder retraction</td>
<td>3B2</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Telescopic cylinder retraction</td>
<td>4B1, 3B2</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>Swing cylinder retraction</td>
<td>4B2</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Telescopic cylinder retraction Receiving cylinder retraction</td>
<td>3B1, Valve sensor for grinding machine</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>Push out cylinder</td>
<td>3B1, 4B1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
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<td>+</td>
</tr>
<tr>
<td>12</td>
<td>Telescopic cylinder Pusher cylinder retraction</td>
<td>5B1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1. Electromagnet work order sheets.
Loop of the communist party of China to use the seven sensors [8], complete each movement via electromagnet power and signal sources as shown in table 1. Press the start button, 2 b1 sensor detects whether material cylinder in place, if material cylinder in place, the points of material cylinder, cent gives a single valve, by picking cylinder to move 5, picking out cylinder in place, 2 b2 signal sensor, cylinder swing arm stretched out, and drive the manipulator arm can rotate, scale, telescopic cylinder valve, cylinder back swing arm, mechanical arm rotating back, at this moment need to put the arm on the cylinder within the limit of the sensor 3 b1 and cone grinding machine processing a valve on the sensor signals at the same time, the telescopic cylinder to retract, valve processing to the mouth, also withdraw material cylinder. Sensor 4 b1, 3 b1 signal at the same time, pushing cylinder, valve into grinding machine processing, carry on the processing.

**Summary**

Valve cone grinding machine feeding system design, this paper adopts automatic feeding manipulator, no need to be manually delivery valve, reduce the labor intensity of workers, improve the production efficiency, and solves the workers vulnerable in the process of holding valve transmission problem, improved the security of the production process. Products by the chongqing sinopac elite valve co., LTD., after the actual use, reflect enterprise effect is good, stable running, high efficiency, greatly reduced the cost.

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**References**


